: Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MTEPC11001 – Advanced Engineering Thermodynamics

(HPTE)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Define Claypeyron equation and explain its significance in thermodynamics.	CO1	K2
b.	Difference between exergy and energy.	CO2	K4
c.	Explain the concept of Helm Holtz free energy.	CO3	K2
d.	Define heat of reaction.	CO5	K1
e.	Define enthalpy of combustion.	CO4	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Two kg of air at 500 kPa, 80°C expands adiabatically in a closed System until its volume is doubled and its temperature becomes equal to that of the surroundings which is at 100 kPa, 5°C. For this process, determine (a) the maximum work, (b) the change in availability and (c) the irreversibility. For air, take cv = 0.718 kJ/Kg K, u =cvT where cv is constant, and pV = mRT where p is pressure in kPa, V volume in m^3, m mass in kg, R a constant equal to 0.287 kJ/kg K, and T temperature in K.	10	CO2	K4
	(OR)			
b.	Discuss about Entropy, availability and unavailability.	5	CO1	K2
c.	Define enthalpy. Why the enthalpy of an ideal gas does depend only on temperature?	5	CO1	K1
3.a.	Derive Clausius clapeyron equation.	5	CO3	K4
b.	From T – ds equation derive Cp – Cv = $tV\beta^2/K$.	5	CO3	K4
	(OR)			
c.	Show that there is no change in temperature when an ideal gas is made to undergo a Joule Thomson expansion.	5	CO3	K2
d.	Determine the change in entropy of 0.5 kg of air compressed polytropically from 1bar to 0.8 MPa and 800 K following index 1.2. Take C_v=0.718kJ/kg-K.	5	CO2	K2
4.a.	Air at 300 kPa and 200^0C is in a piston cylinder arrangement with a volume of 0.1 m^3. It is now compressed in polytropic process with exponent n = 1.2 to a final temperature of 300^0C. Calculate the heat transfer for the process.	10	CO4	K2
	(OR)			
b.	Derive the first and second TdS equations. Also derive the expression for difference in specific heat capacities Cp and Cv. What does the expression signify?	10	CO4	K4

c.	Define Gibbs phase rule for non-reactive system? Explain about degree of freedom.	5	CO1	K2
5.a.	Write down about Maxwell Boltzmann distribution for different kind of molecular speed.	5	CO5	K1
b.	Explain through a suitable example the difference between the first and second law efficiencies.	5	CO5	K2
	(OR)			
c.	Briefly explain Fermi Dirac and Bose Einstein statics	5	CO5	K2
d.	Explain Onsager's reciprocal relation.	5	CO6	K2
6.a.	Methane is reversibly compressed at 230 K in a steady state steady flow (sssf) device from 150 bar to 1000 bar. Using the fugacity charts, determine work done in kJ/Kmol. Critical pressure is 46.4 bar and critical temperature is 190.7K.	10	CO5	K3
	(OR)			
b.	Explain thermochemical exergy and chemical energy.	5	CO4	K2
c.	Describe the viral coefficients. Explain the case when they become zero.	5	CO6	K2

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